5 Other deep-water sharks and skates from the Northeast Atlantic (ICES subareas 4–14)

5.1 Stock distributions

This section includes information about deep-water elasmobranch species other than Portuguese dogfish and leafscale gulper shark (see Section 3), kitefin shark (see Section 4) and Greenland shark (see Section 24). Limited information exists on the majority of the deep-water elasmobranchs considered here, and the stock units for these species are unknown.

The species and generic landing categories for which data are presented are: gulper sharks *Centrophorus* spp., birdbeak dogfish *Deania calcea*, longnose velvet dogfish *Centroscymnus crepidater*, black dogfish *Centroscyllium fabricii*, lanternsharks *nei Etmopterus* spp. Historical catches of knifetooth dogfish *Scymnodon ringens*, arrowhead dogfish *Deania profundorum*, bluntnose sixgill shark *Hexanchus griseus*, mouse catshark *Galeus murinus* velvet belly lanternshark *Etmopterus spinax* and 'aiguillat noir' (which may include *C. fabricii, C. crepidater* and *Etmopterus* spp.) are also presented in the stock annex. Other deep-water sharks in the ICES area include: deep-water catsharks *Apristurus* spp., frilled shark *Chlamydoselachus anguineus*, great lanternshark *Etmopterus princeps* and sailfin roughshark (sharpback shark) *Oxynotus paradoxus.*

Fifteen species of skate (Rajidae) are known from deep water in the NE Atlantic: Arctic skate *Amblyraja hyperborea*, Jensen's skate *Amblyraja jenseni*, Krefft's skate *Malacoraja kreffti*, roughskin skate *Malacoraja spinacidermis*, deep-water skate *Rajella bathyphila*, pallid skate *Bathyraja pallida*, Richardson's skate *Bathyraja richardsoni*, Bigelow's skate *Rajella bigelowi*, round skate *Rajella fyllae*, Mid-Atlantic skate *Rajella kukujevi*, spinytail skate *Bathyraja spinicauda*, sailray *Rajella lintea*, Norwegian skate *Dipturus nidarosiensis,* blue pygmy skate *Neoraja caerulea* and Iberian pygmy skate *Neoraja iberica*.

Species such as common skate complex, shagreen skate *Leucoraja fullonica*, starry ray *Amblyraja radiata* and longnose skate *Dipturus oxyrinchus* also distributed in shallower waters down to 500 m and are not considered in this section. The electric ray *Torpedo nobiliana* may also occur in deep waters.

Eight species of rabbitfish (Chondichthyes; Holocephali), including members of the genera *Chimaera, Hariotta* and *Rhinochimaera* are a bycatch of some deep-water fisheries and are sometimes marketed. The current zero-TACs for deep-water sharks, whose livers were used to extract squalene, may have led to the increased retention of rabbitfish, particularly common chimaera *Chimaera monstrosa* in Norway to produce "ratfish oil". Catches of Chimaeridae are included in the report of the ICES Working Group on the Biology and Assessment of Deep-sea Fisheries Resources (WGDEEP).

5.2 The fishery

5.2.1 History of the fishery

Most species of other deep-water shark and skate species are taken as by-catch in mixed trawl, longline and gillnet fisheries together with Portuguese dogfish, leafscale gulper shark and deep-water teleosts.

5.2.2 The fishery in 2020

Deep-water elasmobranch species were taken as bycatch in mixed fisheries.

Since 2010, EU TACs for deep-water sharks have been set at zero (see Section 5.2.4) and consequently, reported landings of most of the species covered in this chapter were very low or zero in 2020. As a consequence of this Regulation, it is likely that discarding has increased.

As a consequence of the Council Regulation (EU) 2016/2285, which fixed a restrictive by-catch of deep-sea sharks of 10 tonnes in 2017–2018 and 7 tonnes in 2019–2020 in directed artisanal deep-sea longline fisheries for black scabbardfish, some landings attributed to Portuguese waters are reported from 2017 to 2020.

5.2.3 ICES advice applicable

No species-specific advice is given for the shark and skate species considered here.

5.2.4 Management applicable

The EU TACs that have been adopted for deep-sea sharks in European Community waters and international waters at different ICES subareas are summarized below.

Year	ICES subareas		
	5–9	10	12 (includes also *Deania histricosa* and *Deania profondorum)* [5]
2005 and 2006	6763	14	243
2007	2472[1]	20	99
2008	1646[1]	20	49
2009	824[1]	10[1]	25[1]
2010	0[2]	0[2]	0[2]
2011	0[3]	0[3]	0[3]
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	10[4]	10[4]	0
2018	10[4]	10[4]	0
2019	7[4]	7[4]	0
2020	7[4]	7[4]	0

(1) Bycatch only. No directed fisheries for deep-sea sharks are permitted.
(2) Bycatch of up to 10% of 2009 quotas is permitted.
(3) Bycatch of up to 3% of 2009 quotas is permitted.
(4) Exclusively for bycatch in longline fishery targeting black scabbardfish. No directed fishery shall be permitted.
(5) Recent studies demonstrated that there is not enough scientific support to discriminate *Deania hystricosa* from its congener *Deania calcea*; they are likely the same species (Rodríguez-Cabello *et al.*, 2020; Stefanni *et al.*, 2021)

Since 2013, the deep-sea shark category includes the following species (Council regulation (EC) No 1182/2013): Deep-water catsharks *Apristurus spp*., frilled shark *Chlamydoselachus anguineus*, gulper sharks *Centrophorus spp*., Portuguese dogfish *Centroscymnus coelolepis*, longnose velvet dogfish *Centroscymnus crepidater*, black dogfish *Centroscyllium fabricii*; birdbeak dogfish *Deania calcea*; kitefin shark *Dalatias licha*; greater lantern shark *Etmopterus princeps*; velvet belly *Etmopterus spinax*; mouse catshark *Galeus murinus*; six-gilled shark *Hexanchus griseus*; sailfin roughshark *Oxynotus paradoxus*; knifetooth dogfish *Scymnodon ringens* and Greenland shark *Somniosus microcephalus*.

Since 2013, under NEAFC Recommendation 7, it was required that Contracting Parties prohibit vessels flying their flag in the Regulatory Area from directed fishing for deep-sea sharks on the following list: *Centrophorus granulosus, Centrophorus squamosus, Centroscyllium fabricii, Centroscymnus coelolepis, Centroscymnus crepidater, Dalatias licha, Etmopterus princeps, Apristurus* spp., *Chlamydoselachus anguineus, Deania calcea, Galeus melastomus, Galeus murinus, Hexanchus griseus, Etmopterus spinax, Oxynotus paradoxus, Scymnodon ringens* and *Somniosus microcephalus*.

In 2005, the use of trawls and gillnets in waters deeper than 200 m in the Azores, Madeira and Canary Island areas was banned (Council Regulation (EC) No 1568/2005). In 2007, the use of gillnets by Community vessels at depths greater than 600 m in ICES divisions 6.a-b, 7.b-c, 7.j-k and Subarea 12 was banned while a maximum bycatch of deep-water shark of 5% in hake and monkfish gillnet catches was allowed (Council Regulation (EC) No 41/2007). A gillnet ban in waters deeper than 200 m is also in operation in the NEAFC regulatory Area (all international waters of the ICES Area). NEAFC also ordered the removal of all such nets from NEAFC waters by 1 February 2006.

Since 2009, the "rasco (gillnet)" fishing gear was banned at depths lower than the 600 m isobath (EC Regulation 43/2009,). The regulation affected 4–6 boats in the Basque Country that used this technique. The "rasco" fleet targets anglerfish *Lophius spp*., which represents around 90% of catch weight. This métier is highly seasonal, with the highest activity occurring during winter months. Catches during these months tend to occur in deeper waters, where the nets are sunk to depths down to 1000 m.

Since 2016, and in order to mitigate the potential damaging impacts of bottom trawling, fishing with bottom trawls was permitted only at, or above, a depth of 800 metres (EU Regulation 2016/2336).

A by-catch TAC for deep-water sharks was allowed for each of the years from 2017 to 2020, on a trial basis, in the directed artisanal deep-sea longline fisheries for black scabbardfish (Council regulation (EU) 2016/2285; Council regulation (EU) 2018/2025). According to this limited landing of unavoidable by-catches of deep-sea sharks were allowed and Member States should develop regional management measures for the black scabbardfish fishery and establish specific data-collection measures for deep-sea sharks to ensure their close monitoring. Specifically, 10 and 7 tonnes were allowed for deep-sea sharks in Union and international waters of ICES subareas 5, 6, 7, 8 and 9, in Union and international waters of ICES Subarea 10 and in Union waters of CECAF 34.1.1, 34.1.2 and 34. 2 in 2017–2018 and 2019–2020, respectively. This allowance was in accordance with ICES indications according to which in the artisanal deep-sea longline fisheries for black scabbardfish, the restrictive catch limits lead to misreporting of unavoidable by-catches of deep-sea sharks, which are currently discarded dead.

The Council regulation (EU) 2016/2285 affects specifically the Portuguese deep-water longline fishery targeting black scabbardfish in ICES Division 9.a and Subarea 10. As a response Portugal has proposed an action plan focusing the black scabbardfish fishery and this plan is coordinated by the Portuguese General Directorate of Fisheries. Among other objectives, under this plan different management strategies were expected to be evaluated.

The council regulation (EU) 2021/91 fixing, for the years 2021 and 2022, the fishing opportunities for Union fishing vessels for certain deep-sea fish stocks, prohibits to fish for deep-sea sharks in ICES subareas 5 to 9, in Union and international waters of ICES subarea 10, in international waters of ICES subarea 12 and in Union waters of CECAF areas 34.1.1, 34.1.2 and 34.2, and to retain on board, tranship, relocate or land deep-sea sharks caught in those areas, with no exceptions.

5.3 Catch data

5.3.1 Landings

Landings estimates from 2005 onwards were revised following WKSHARK2 (updated in WGEF 2018). Information, by species, is presented below. Past information is presented in the stock annex. Due to the management measures in force for deep-water sharks their landings in 2020 continued to be low (tables 5.1–5.8).

Gulper sharks *Centrophorus* spp. (excluding *C. squamosus*)

WGEF landings estimates of gulper sharks are presented in tables 5.1 and 5.7.

In 2020, under the 7 tonnes TAC, 0.5 tonnes were landed by the Portuguese deep-water longline fleet.

Birdbeak dogfish *Deania calcea*

WGEF landings estimates of birdbeak dogfish are presented in tables 5.2 and 5.7.

Five European countries reported landings of birdbeak dogfish: Norway, Ireland, UK, Spain and Portugal. In 2020, under the 7 tonnes EU TAC, 1.8 tonnes were landed by the Portuguese deep-water longline fleet. Landings < 0.1 were also reported by Norway in 2020.

Longnose velvet dogfish *Centroscymnus crepidater*

WGEF landings estimates of longnose velvet dogfish are presented in tables 5.3 and 5.7.

In 2020, under the 7 tonnes TAC, 0.2 tonnes were landed by the Portuguese deep-water longline fleet.

Black dogfish *Centroscyllium fabricii*

Reported landings of black dogfish are presented in tables 5.4 and 5.7.

A total of 0.2 tonnes were reported by Iceland in 2020.

Lanternsharks *Etmopterus* spp.

Reported landings of velvet belly lanternshark *Etmopterus spinax* are presented in Table 5.5 until 2004. Revised landing data provided to WGEF from 2005 onwards indicates that landings assigned to *E. spinax* should be considered as *Etmopterus* spp. Those figures are provided in tables 5.6 and 5.7. Six countries have reported landings of *Etmopterus* spp.: Denmark, Norway, UK, France, Spain and Portugal. Until 2001, the greatest landings were from Denmark. Norway reported 171 tonnes in 2020, the highest value reported of *Etmopterus* spp.

Portuguese landings mainly referred to *Etmopterus spinax* and *Etmopterus pusillus,* however, only a very small proportion of the catches of these species is retained.

Catches of this species by Russian deep-water longline fisheries in the Faroese Fishing Zone and other Northeastern Atlantic areas were reported in working documents to WGEF (Vinnichenko and Fomin, 2009 WD; Vinnichenko *et al*., 2010 WD). Landings data from this fishery were not subsequently available to the working group.

Other species

There are landings information for other deep-water shark species, presented in Table 5.7. Other reported landings are sporadic and very low and thus were not presented.

5.3.2 Discards

Historical discards from Portugal (Azores and mainland) and Spain are available in the stock annex.

Ireland: Discard data from Ireland is available since 2009 from the trawl fleet operating in ICES divisions 27.6.a and 27.7.bgj (Table 5.8). Discards are considered negligible as values estimated are <1 tonne in most of the years.

Denmark: Discard data from *E. spinax* is available from 2009 to 2017 (Table 5.8). This species is mostly discarded by the trawl fleet from areas 27.3.a, 27.4.a and 27.4.b. Discards varied among years but has remained around 5–6 tonnes in 2016 and 2017.

Sweden: Discard data from *E. spinax* is available for 2019 (Table 5.8).

5.3.3 Quality of the catch data

Data provided to WGEF since 2017 followed WKSHARK2 guidelines. Despite the decisions taken regarding the assignment of landings to species or higher *taxa* some problems persist. For example, some quantities of deep-water species are maintained grouped in generic categories such as “sharks indetermined”, “unidentified deepwater sharks” or “Squaliformes”.

Irish discard values (2009–2020) were updated in 2021.

As result of restrictive quotas for deep-water sharks, landings of these species may have been misidentified.

5.3.4 Discard survival

No data available to the Working Group.

5.4 Commercial catch composition

No new information is available.

5.5 Commercial catch and effort data

No new information is available.

5.6 Fishery-independent surveys

5.6.1 ICES Subarea 6

The Scottish deep-water trawl survey has operated from 1996 to 2017 at depths of 300–2000 m along the continental slope between approximately 55°N and 59°N (see Neat *et al*. (2010) for details). Neat *et al*. (2015) analysed catches of deep-water elasmobranch species from Scottish deep-water trawl survey.

5.6.2 ICES Subarea 7

The Spanish survey on the Porcupine Bank (SpPGFS-WIBTS-Q4) in ICES divisions 7.c and 7.k covers an area from longitude 12°W to 15°W and from latitude 51°N to 54°N following the standard IBTS methodology for the western and southern areas (ICES, 2010). The sampling design is a random stratified (Velasco and Serrano, 2003) with two geographical sectors (North and South) and three depth strata (<300 m, 300–450 m and 450–800 m). Haul allocation is proportional to the strata area following a buffered random sampling procedure (as proposed by Kingsley *et al*., 2004) to avoid the selection of adjacent 5×5 nm rectangles. More details on the survey design and methodology are presented in ICES (2017). In 2019, elasmobranchs constituted ~8% of that total fish caught. Results for 2020 are presented in Fernández-Zapico *et al*. (WD03 2021a). The most abundant deep-water shark species in biomass in these surveys are *D. calcea* (birdbeak dogfish), *S. ringens* (knifetooth dogfish), *E. spinax* (velvet belly lantern shark), *D. licha* (kitefin shark), and *H. griseus* (bluntnose six-gill shark). Length distributions for these species are presented in the working document presented to WGEF (see Fernández-Zapico *et al*., WD03 2021a).

5.6.3 ICES divisions 8.c and 9.a

From 2015 to 2019, AZTI conducted a deep-water longline survey (PALPROF) along the Basque Coast (600–2400 m deep) onboard a commercial longliner, with the objective of estimating and assessing the inter-annual variation of the abundance and biomass indices of the deep-water sharks and other ichthyofauna (Diez *et al*., WD01 2021). More information is presented in Section 3.9.2. from Section 3 (3. Deep-water sharks; Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14)).

The Spanish survey in the Cantabrian Sea and Galician waters (SpGFS-WIBTS-Q4) has covered this area annually since 1983 (except 1987), obtaining abundance indices and length distributions for the main commercial species and elasmobranchs. A new vessel (R/V Miguel Oliver) is in use since 2013. More details on the survey design, methodology and results can be found in ICES (2017). In 2020, elasmobranchs represented 11% of the total fish caught (Fernández-Zapico *et al*., WD04 2021b). Length distribution for the most abundant species are presented in the working document presented to WGEF (see WD04 - Fernández-Zapico *et al*., 2021b).

In the Portuguese survey (PtGFS-WIBTS-Q4) taking place off southwestern and southern coasts, the deep-water elasmobranchs with highest catches are *E. spinax* and *D. profundorum*. This survey is designed for crustacean species and operates to depths of 700 m.

5.6.4 ICES Subarea 10

Data from the Azorean bottom longline survey (ARQDACO(P)-Q1) in Division 10.a2 were given in Pinho and Silva (2017, WD). *Deania* spp. were the most representative (abundant) species in the survey. *Centroscymnus crepidater* was common, but much less abundant. Other species

occurred in very low numbers (averaging 1–4 individuals per year). Depth range sand length composition data are available. It should be noted that the gear configuration used is not adequate for sampling all the species (Pinho and Silva, 2017 WD).

5.7 Life-history information

See Stock annex for further details.

5.8 Exploratory assessments analyses of relative abundance indices

The exploratory assessments below are all based on analyses of relative abundance or biomass indices in fishery-independent surveys.

Information previously submitted to WGEF for the black dogfish *C. fabricii,* the longnose velvet dogfish *C. crepidater,* the greater lantern shark *E. princeps,* the small-eye catshark *A. microps,* the pale catshark *A. aphyodes* and other deep-water skates and rays are presented in the stock annex.

5.8.1 Summary of trends by species

Birdbeak dogfish *Deania calcea* and Arrowhead dogfish *Deania profundorum*

In the SpPGFS-WIBTS-Q4 survey series, these two species were traditionally registered together, but have been better separated since 2012. The biomass and abundance of *Deania* spp. (mainly *D. calcea*) have followed a downward trend since 2016 but increased in 2020 to values close to 2018 (Figure 5.1). The biomass and abundance of *D. profundorum* were negligible (Fernández-Zapico *et al*., WD03 2021a).

In the SpGFS-WIBTS-Q4, both species are more frequent in additional deeper hauls (>500 m) and scarce or absent on the standard hauls (70–500 m) (Figure 5.2). After two years without records, *Deania calcea* was captured again in 2019 and 2020 with a biomass quite higher than the value recorded in 2016. The biomass of *D. profundorum* increased in relation to the previous years (Fernández-Zapico *et al*., WD04 2021b).

This species has been caught by the PALPROF survey in ICES Division 8.c (2015–2019). The species is frequent (the second more abundant species in most of the years) and the CPUE values are variable, showing no trend (Figure 5.3) (Diez *et al*., WD01 2021).

Knifetooth dogfish *Scymnodon ringens*

In the Spanish Porcupine survey (SpPGFS-WIBTS-Q4) the biomass and abundance of *S. ringens* increased in 2020 (Figure 5.4) (Fernández-Zapico *et al*., WD03 2021a). Since 2006 that the values fluctuated with no evident trend.

Biomass values of this species in the SpGFS-WIBTS-Q4 survey in the Cantabrian Sea and Galician waters are very low. This species is mostly caught in the additional deeper hauls. In these, biomass have fluctuated with no evident trend (Figure 5.5) (Fernández-Zapico *et al*., WD04 2021b).

Velvet belly lanternshark *Etmopterus spinax*

Although the abundance of ***E. spinax*** increased in 2020, the biomass decreased compared to the previous year. The values have been following an up and down trend throughout the time series, without any trend (Figure 5.6; Fernández-Zapico *et al.,* WD03 2021a).

In the SpGFS-WIBTS-Q4 survey in the Cantabrian Sea and Galician waters the biomass increased substantially in standard hauls in 2020, corresponding to the highest value in the time series (Figure 5.7). A high fraction of the biomass of this elasmobranch is usually found in hauls deeper than 500 m (Fernández-Zapico *et al.*, WD04 2021b). In the additional deep hauls, the mean biomass of this species remained close to the values observed in the last years.

Bluntnose six-gill shark *Hexanchus griseus*

The stratified biomass index of *H. griseus* in the Spanish Porcupine survey (SpPGFS-WIBTS-Q4) increased in 2020 but the abundance decreased. The overall series present no trend, being more or less stable along the years (Figure 5.8) (Fernández-Zapico *et al*., WD03 2021a).

In the SpGFS-WIBTS-Q4 survey in the Cantabrian Sea and Galician waters, the biomass of *H. griseus* in 2020 decreased in standard hauls but the value is still among the highest of the time series (Figure 5.9). Comparatively to 2019, the biomass increased in the additional deep hauls (Fernández-Zapico *et al*., WD04 2021b).

Other deep-water elasmobranchs

In 2020, *Dipturus nidarosiensis* were caught in eight hauls of the Spanish Porcupine survey (SpPGFS-WIBTS-Q4) (Fernández-Zapico *et al*., WD03 2021a).

Etmopterus pusillus and *Centroscymnus crepidater*, were caught in low numbers in the SpGFS-WIBTS-Q4 survey conducted in 2020 in the Cantabrian Sea and Galician waters (Fernández-Zapico *et al*., WD04 2021b).

Centroscymnus crepidater and *Etmopterus princeps* were caught in the PALPROF survey in ICES Subdivision 8.c and CPUE data is available for the period 2015–2020 (Figure 5.3) (Diez *et al*., WD01 2020).

5.9 Stock assessment

No formal assessments are undertaken for these stocks.

5.10 Quality of assessments

No assessments undertaken.

5.11 Reference points

No reference points have been proposed for any of the species.

5.12 Conservation considerations

The European Red List of marine fishes considers *C. granulosus* to be Critically Endangered, *Echinorhinus brucus*, *D. calcea* and *D. nidarosiensis* as Endangered; and *Centrophorus uyato* and *Oxynotus centrina* as Vulnerable (Nieto *et al*., 2015).

Recent IUCN assessments for a group of deep-water sharks classified *C. crepidater*, *D. profundorum*, *D. calcea* and *H. griseus* as globally Near Threatened, *S. ringens* as globally Vulnerable, *C. granulosus*, *C. uyato* and *E. brucus* as globally Endangered. All these species were considered to have their populations stable or increasing in the NE Atlantic (Finucci *et al*. 2020a, b, c, d, e, f, g).

5.13 Management considerations

No management advice is given in 2020.

5.14 References

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Table 5.1. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of gulper sharks (*Centrophorus granulosus* and *Centrophorus* spp.) in tonnes. Portuguese landings ([1]) are assigned to *Centrophorus* spp. (not *C. squamosus*) whereas Irish landings ([2]) are assigned to *C. granulosus*. Estimates from 2005 onwards were revised following WKSHARK2.

	UK	Portugal[1]	Spain	Ireland[2]	Total
1990		1056			1056
1991		801			801
1992		958			958
1993		886			886
1994		344			344
1995		423			423
1996		242			242
1997		291			291
1998		187			187
1999		95			95
2000		54			54
2001		96			96
2002		159	8		167
2003	643	203			846
2004	481	89	n.a.		570
2005		49	n.a.	14	64
2006		100			100
2007		62			62
2008		56			56
2009		17			17
2010		7			7
2011		2	+		2
2012		1			1
2013		+			+
2014		+			+
2015		+			+
2016		+			+
2017		2			2
2018		4			4
2019		+			+
2020		0.5			0.5

+ = catch under 0.5 tonnes

Table 5.2. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of birdbeak dogfish (*Deania calcea*), in tonnes. Estimates from 2005 onwards were revised following WKSHARK2.

	Ireland	Spain	UK	France	Portugal	Norway	Total
1990							
1991							
1992							
1993							
1994							
1995							
1996							
1997							
1998							
1999							
2000					13		13
2001			1		37		38
2002		5	+		67		72
2003		n.a.	3		72		75
2004		n.a.	38		157		195
2005			50		146		195
2006			22		75		96
2007					37		37
2008				5	57		62
2009				2	22		25
2010				+	3		3
2011					1		1
2012	2				1		3
2013					0	+	+
2014						+	+
2015					0	+	+
2016						+	+
2017					2	+	3
2018					1	+	1
2019					5	+	5
2020					2	+	2

+ = catch under 0.5 tonnes

Table 5.3. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of longnose velvet dogfish (*Centroscymnus crepidater*), in tonnes. Estimates from 2005 onwards were revised following WKSHARK2.

	France	Ireland	UK	Portugal	Spain	Total
1990						
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999	+		+			+
2000	+		+	1	85	86
2001	+		+	3	68	71
2002	13		+	4	n.a.	17
2003	10		21	2	n.a.	33
2004	8		7	1	n.a.	16
2005	10		209	3		222
2006	4		409	7		420
2007	2	2	109	18		131
2008	4			33		37
2009	6			27		33
2010	40			+		40
2011						
2012						
2013						
2014				+		+
2015				+		+
2016	+			+		+
2017				1		1
2018				1		1
2019				1		1
2020				+		+

+ = catch under 0.5 tonnes

Table 5.4. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of black dogfish (*Centroscyllium fabricii*), in tonnes. Estimates from 2005 onwards were revised following WKSHARK2.

	France	Iceland	UK	Spain	Total
1990					
1991					
1992		1			
1993					
1994					
1995		1			
1996		4			
1997					
1998					
1999	+				
2000	382			85	467
2001	395			91	486
2002	47	+		n.a.	47
2003	90	+	+	n.a.	90
2004	49	n.a.	+	n.a.	49
2005	12		5		17
2006	3				3
2007	6				6
2008	136				136
2009	99	1			101
2010	85	10			95
2011	+	1			1
2012	1	3			3
2013	+	1			1
2014	9	+			9
2015	+	2			2
2016	+	+			+
2017					+
2018					
2019					
2020		+			+

+ = catch under 0.5 tonnes

Table 5.5. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of velvet belly lanternshark (*Etmopterus spinax*), in tonnes.

	Norway	Denmark	Spain	France	Total
1990					
1991					
1992					
1993		27			27
1994		+			+
1995		10			10
1996		8			8
1997		32			32
1998		359			359
1999		128			128
2000		25			25
2001		52			52
2002			85		85
2003					
2004					

Table 5.6. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of *Etmopterus* spp, in tonnes. Estimates from 2005 onwards were revised following WKSHARK2.

	Denmark	Norway	France	Spain	Portugal	UK	total
1990							
1991							
1992							
1993							
1994			846		+		846
1995			2388		+		2388
1996			2888		+		2888
1997			2150		+		2150
1998			2043				2043
1999			+				+
2000			+	38	+		38
2001			+	338			338
2002			+	99			99
2003			+				+
2004			+		+		+
2005	16			2	+	9	27
2006	17			27	+		44
2007	9			87		8	103
2008	46		+	6		20	72
2009			1	9			9

	Denmark	Norway	France	Spain	Portugal	UK	total
2010	4	9	2				15
2011		4	1	1*	+	+	5
2012		13	+	2*	+		13
2013		19	+			+	19
2014		47				+	47
2015		27	1		+	+	28
2016		59	+				59
2017		129	+				129
2018		106**				4**	110
2019		163**				7**	170
2020		171**					171

*** assigned to *Etmopterus pusillus***

*** * assigned to *Etmopterus spinax***

Table 5.7. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings by species since 2005, after revision following WKSHARK2 (in tonnes), (DWS = Unspecified deep-water sharks).

Species	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gulper shark	64	100	62	56	17	7	2	1	+	+	+	+	2	4	+	1
Centroscymnus spp.	545	514	699	537	384											
Birdbeak dogfish	195	96	37	62	25	3	1	3	+	+	+	+	3	1	5	2
Longnose velvet dogfish	222	420	131	37	33	40				+	+	+	1	1	1	+
Black dogfish	17	3	6	136	101	95	1	3	1	9	2	+				+
Lanternsharks	27	44	103	72	9	15	5	13	19	47	28	59	129	110	170	171
Knifetooth dogfish	65	56	161	156	36	53	2	3	+	+						
Arrowhead dogfish			1		+	1	2	1			+		1			
Bluntnose sixgill shark	13	13	54	2	5	2	2	1	2	+	1	+				+
Mouse catshark			+	+	3	2	5	1	4	4	2	3				
Unidentified DWS*	110	62	111	51	37	40	42	175	89	118	85	91	131	150	168	155

*** Also allocated to "Squaliformes" and "unidentified deep-water squaloid sharks and dogfishes"**

Table 5.8. Other deep-water sharks and skates from the Northeast Atlantic. Discards estimates from Ireland and Denmark (in tonnes). Unspec. DWS = Unspecified deep-water sharks.

Year	Ireland						Denmark	Sweden
	C. fabricii	*E. princeps*	*H. griseus*	*E. spinax*	Unspec. DWS	*D. nidarosienesis*	*Etmopterus* spp,	*Etmopterus* spp.
2009		0.97				0.29	23.49	
2010	3.05					0.74	146.61	
2011		0.01				2.14	50.70	
2012		0.04					16.34	
2013						2.13	24.82	
2014						0.90	3.63	
2015	1.50	3.24				0.40	34.30	
2016	12.06	0.68		0.34	5.40	5.40	5.54	
2017	0.17					42.30	5.41	
2018			5.83	5.83		1.42		
2019				0.07				12.72
2020				1.07				

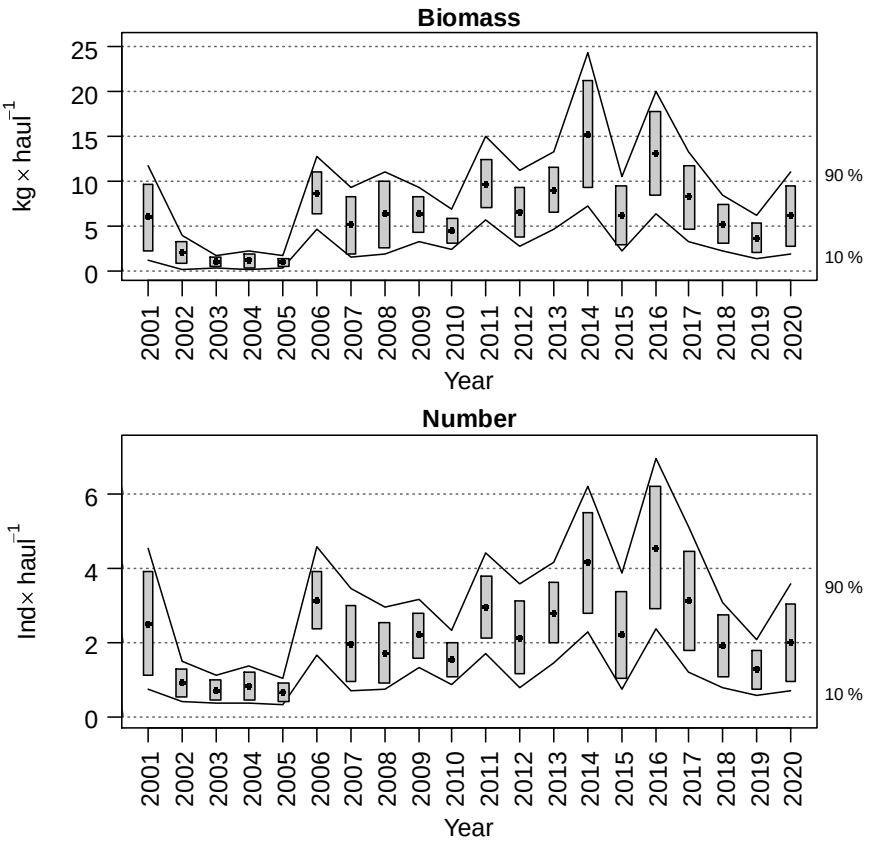

Figure 5.1. Other deep-water sharks and skates from the Northeast Atlantic. *Deania* spp., mainly birdbeak dogfish *Deania calcea* biomass index (kg haul^{-1}) from the Spanish Porcupine survey time-series (SpPGFS-WIBTS-Q4, 2001–2019). Boxes show parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). From Fernández-Zapico *et al.* (WD03 2021a).

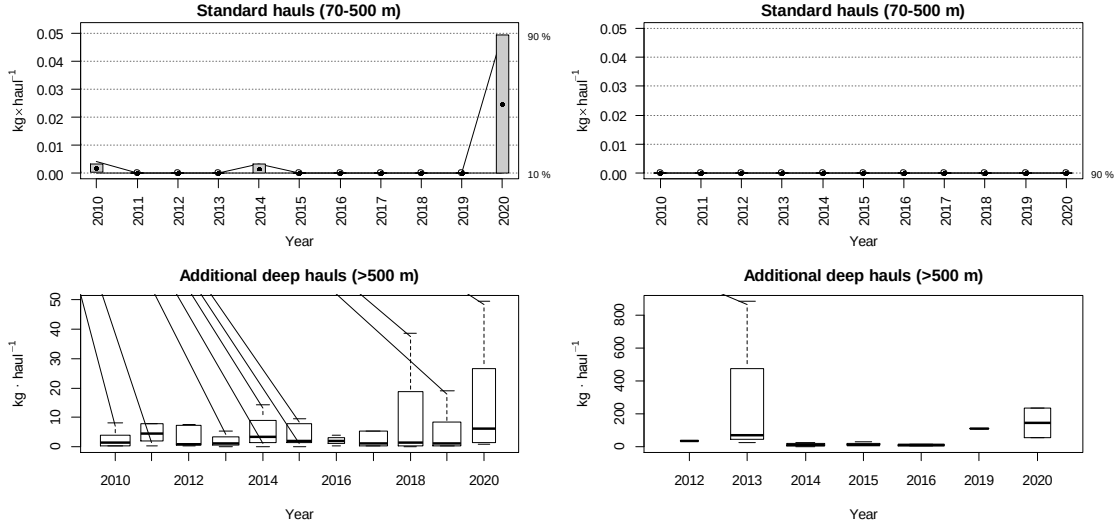

Figure 5.2. Other deep-water sharks and skates from the Northeast Atlantic. Evolution of *Deania profundorum* and *Deania calcea* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series (SpGFS-WIBTS-Q4, 2009–2019). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000). From Fernández-Zapico *et al.* (WD03 2021b).

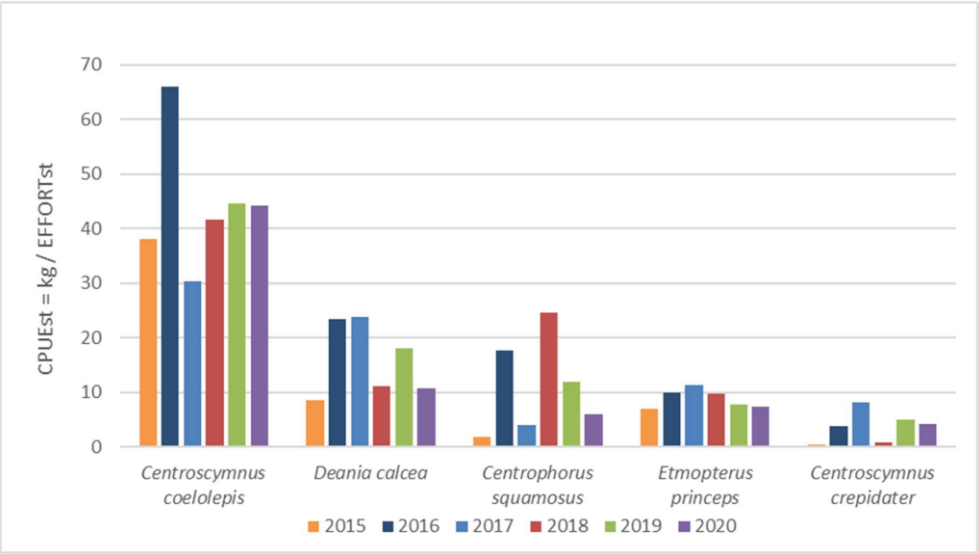

Figure 5.3. Other deep-water sharks and skates from the Northeast Atlantic. CPUE of the five main deep-water sharks caught by the PALPROF survey conducted in the coast along the Basque Country in the period 2015–2019. Results for *Deania calcea*, *Etmopterus princeps* and *Centroscymnus crepidater*. From Diez *et al.* (WD01 2021)

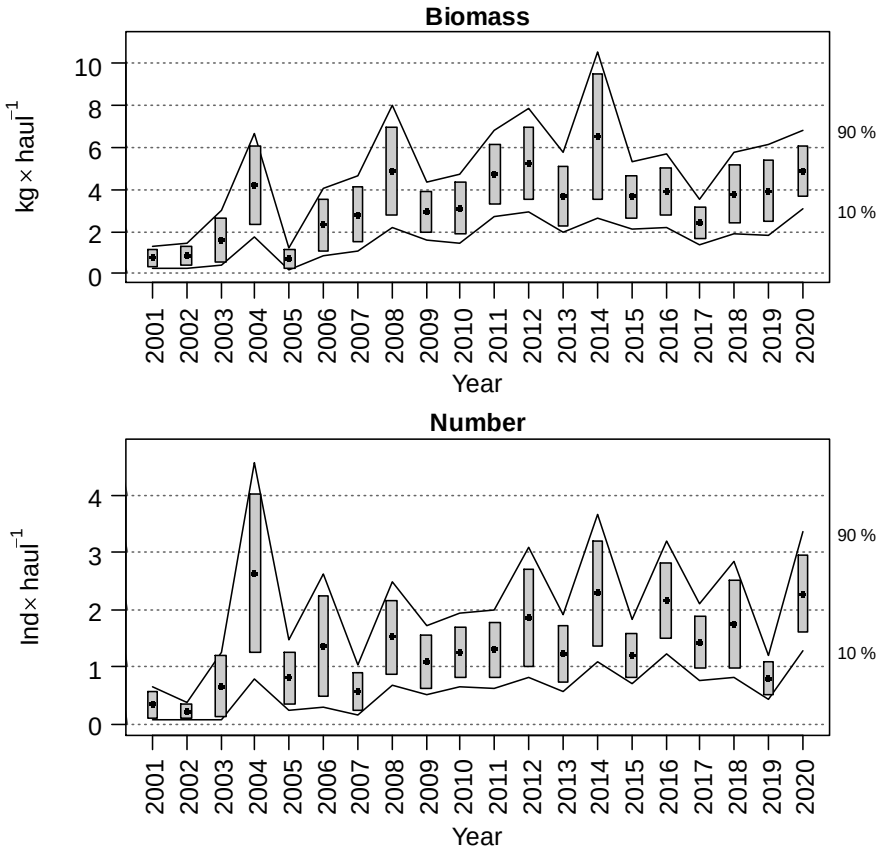

Figure 5.4. Other deep-water sharks and skates from the Northeast Atlantic. Knifetooth dogfish *Scymnodon ringens* biomass index (top, kg haul^{-1}) and abundance index (bottom, numbers). Haul in the Spanish Porcupine survey time-series (SpPGFS-WIBTS-Q4, 2001–2019). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). From Fernández-Zapico *et al.* (WD03 2021a).

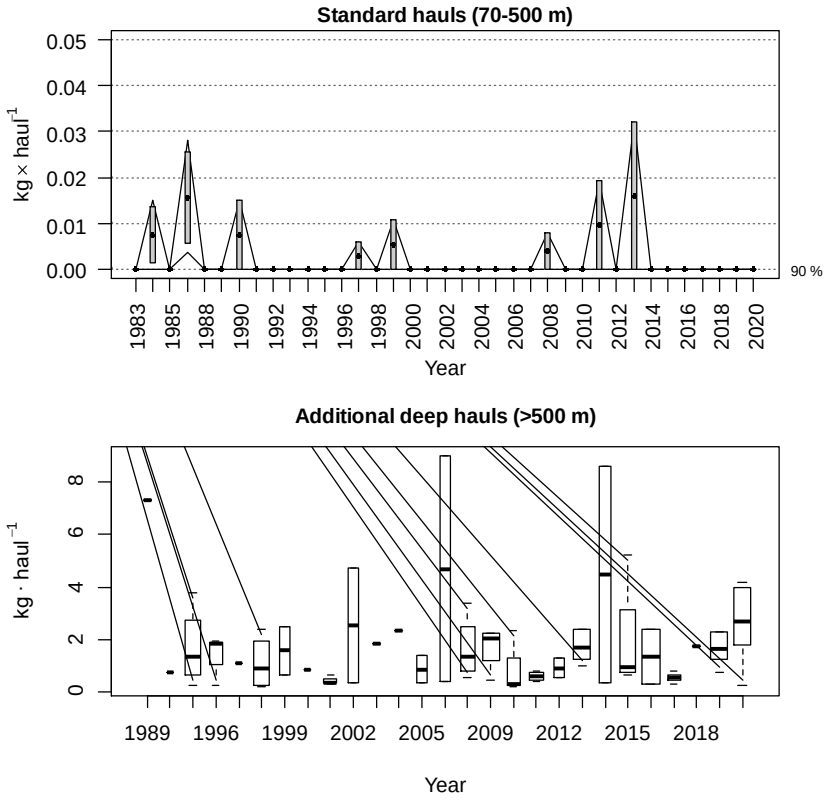

Figure 5.5. Other deep-water sharks and skates from the Northeast Atlantic. Evolution of *Scymnodon ringens* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series (SpGFS-WIBTS-Q4, 1983–2019). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000). From Fernández-Zapico *et al*. (WD03 2021b).

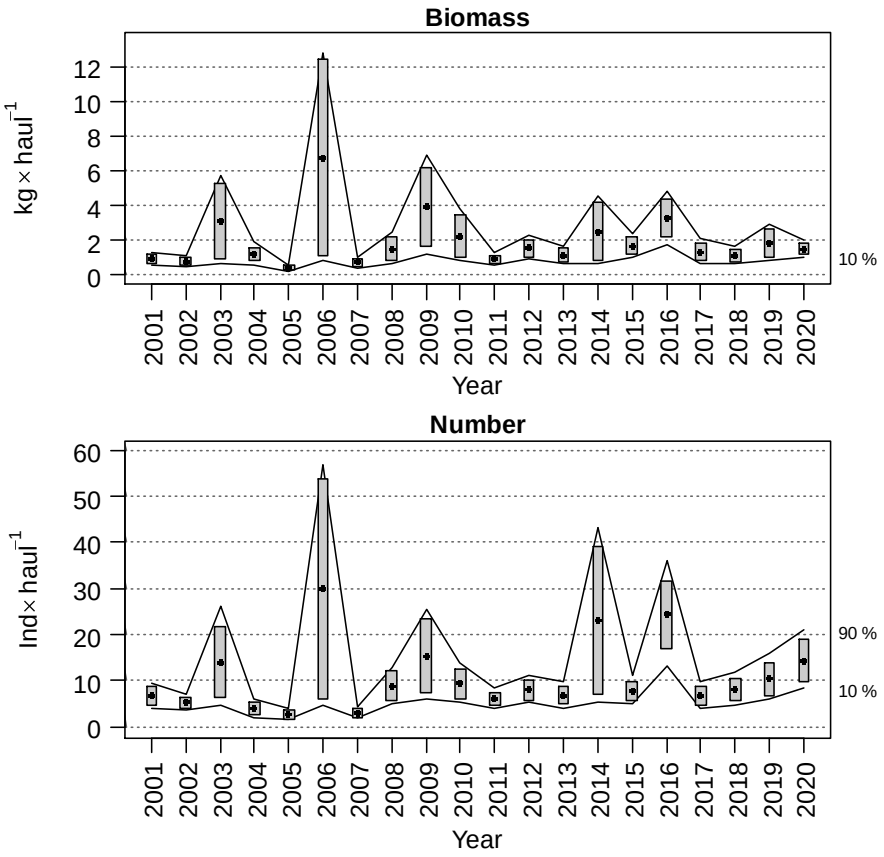

Figure 5.6. Other deep-water sharks and skates from the Northeast Atlantic. *Etmopterus spinax* biomass index (top, kg haul–1) and abundance index (bottom, numbers haul–1) during Porcupine survey time-series (SpPGFS-WIBTS-Q4, 2001–2019). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). From Fernández-Zapico *et al*. (WD03 2021a).

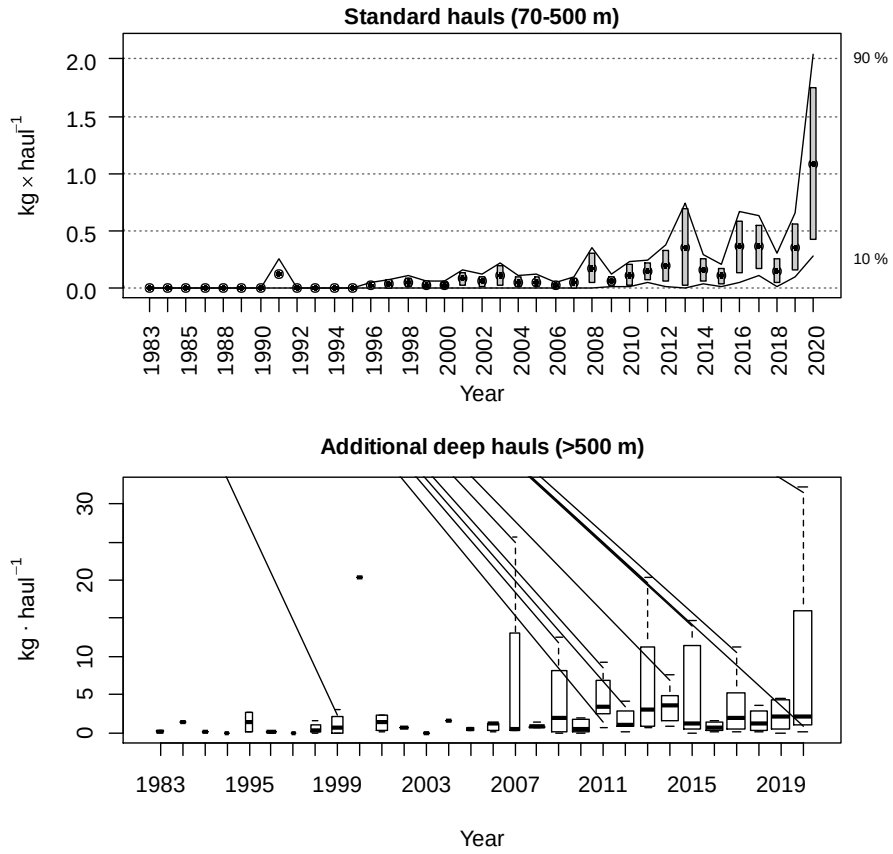

Figure 5.7. Other deep-water sharks and skates from the Northeast Atlantic. Evolution of *Etmopterus spinax* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series (SpGFS-WIBTS-Q4, 1983–2019) covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000). From Fernández-Zapico *et al*. (WD03 2021b).

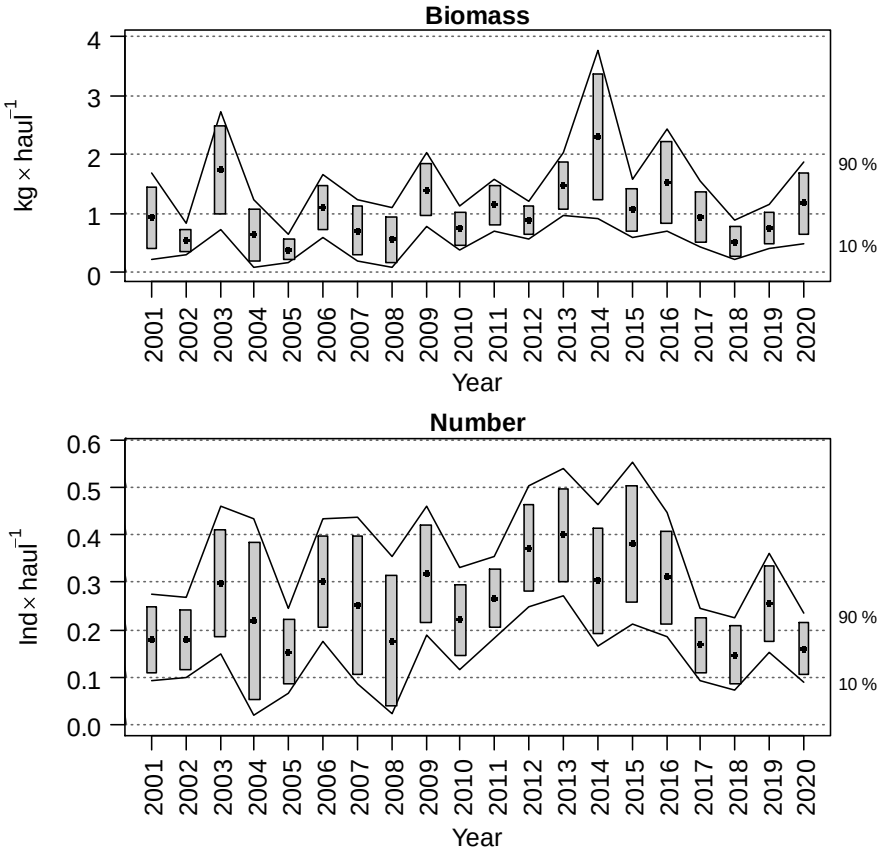

Figure 5.8. Other deep-water sharks and skates from the Northeast Atlantic. Changes in bluntnose six-gill shark *Hexanchus griseus* biomass index (kg haul^{-1}) during Porcupine survey time-series (SpPGFS-WIBTS-Q4, 2001–2019). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). From Fernández-Zapico *et al.* (WD03 2021a).

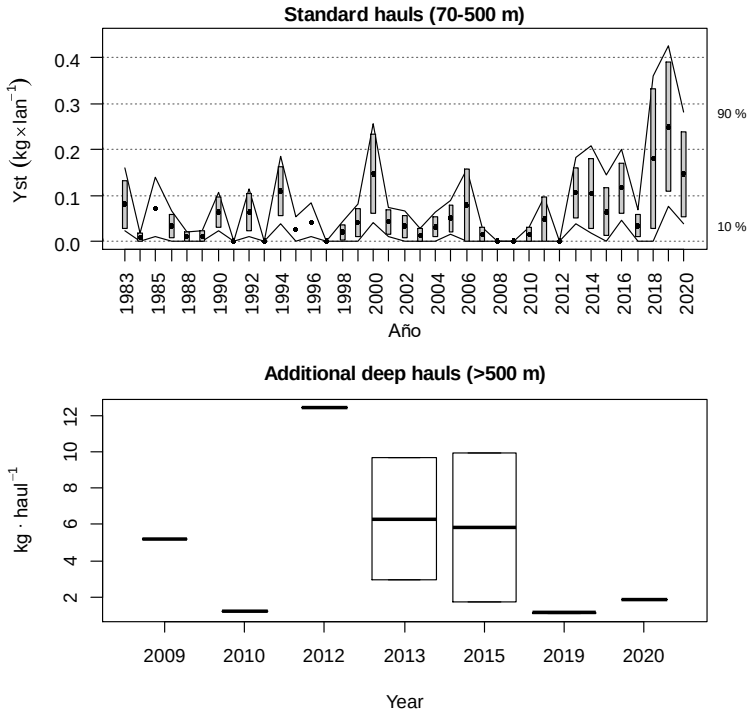

Figure 5.9. Other deep-water sharks and skates from the Northeast Atlantic. Evolution of *Hexanchus griseus* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series (SpGFS-WIBTS-Q4, 1983–2019). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000). From Fernández-Zapico *et al.* (WD03 2021b).